



Assessment of Vehicle Mass Reduction Feasibility, Cost and Safety Effects for CAFE and GHG Rulemaking

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Topics

- ▶ 2017 and Beyond CAFE & GHG Rulemaking
 - ▶ Mid-term Evaluation and NHTSA MYs 2022-2025 Full Rulemaking
 - ▶ Assessment of Mass Reduction Feasibility and Cost for Rulemaking
 - ▶ Assessment of Effects of Mass Reduction on Safety for Rulemaking
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MY 2017+ CAFE & GHG Emission Rulemaking

- ▶ NHTSA and EPA joint federal rulemaking
 - NHTSA - Fuel Economy standards.
 - EPA – Greenhouse Gas Emission standards.
 - CARB – Accept EPA standards as compliance with California standards.
- ▶ Extensive technical, economic and environmental analyses.
- ▶ The standards are performance-based
 - Manufacturers will choose the technologies they will use for compliance.

Mid Term Evaluation

2017

2021

2022

2025



Final unless changed by rulemaking



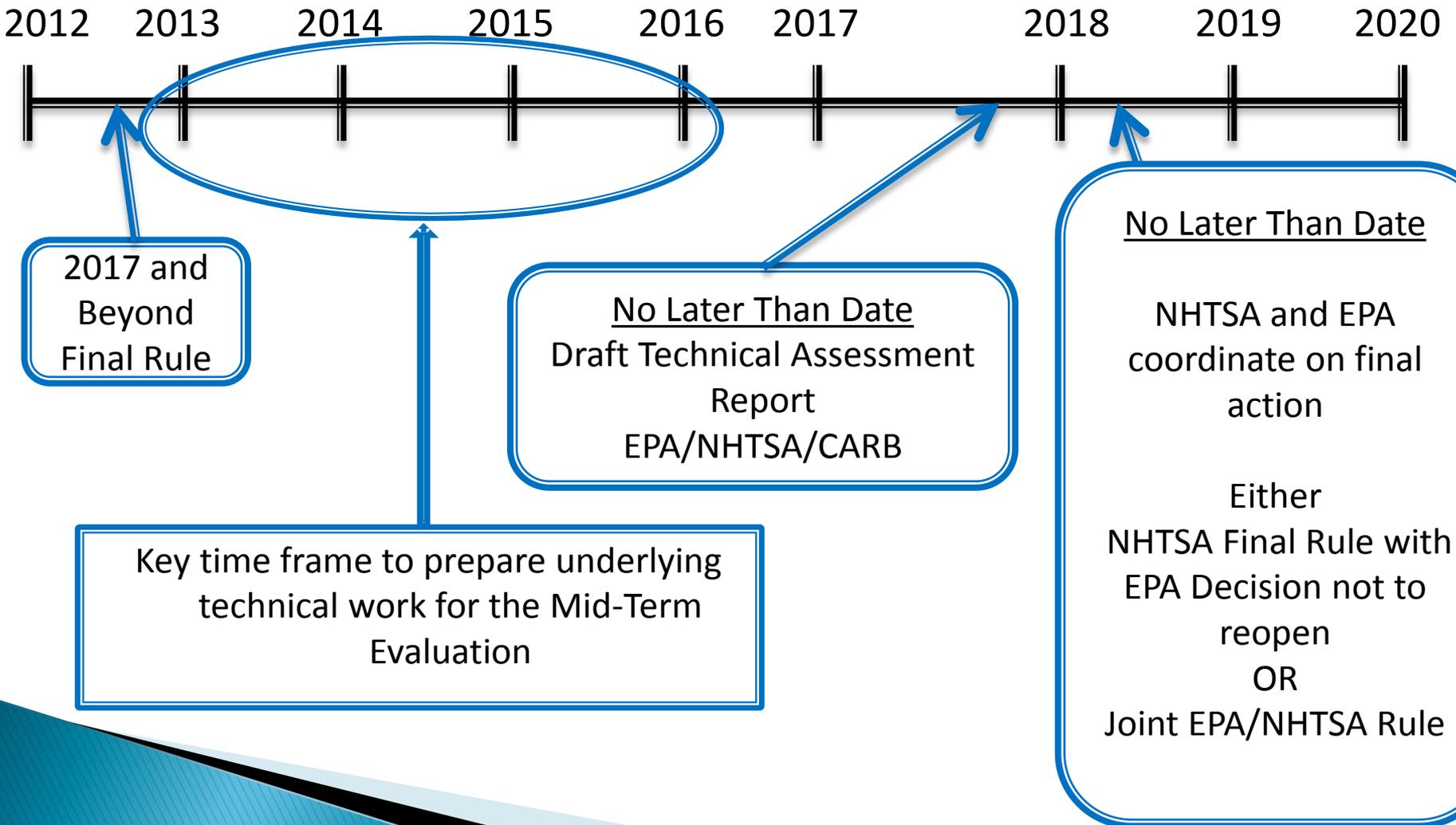
2017-2021
Final

2022-2025
Augural



Joint Technical
Assessment Report

“No Later Than” Timeline for 2022-2025 NHTSA Rulemaking and Midterm Evaluation



Fuel Economy Improving Technologies

Engine:

Low friction lubricants
Engine friction reduction
Camshaft phasing control (VVT)
Valve lift control (VVL)
Cylinder deactivation

Stoichiometric Gasoline Direct Injection
Combustion restart
Turbocharging and downsizing
Cooled EGR
Advanced Diesel

Transmission;

6-speed manual
Improved automatic trans control
High efficiency gears

6-, 7-, and 8-speed automatic
6- and 8-speed Dual clutch transmission
Shift optimization

Electrification and Accessories:

Electric power steering

Improved accessories

Hybrid Technologies:

12v micro hybrid (start-stop)
Belt mounted integrated starter generator

Plug-in hybrid
EV

Vehicle Technologies:

MASS REDUCTION

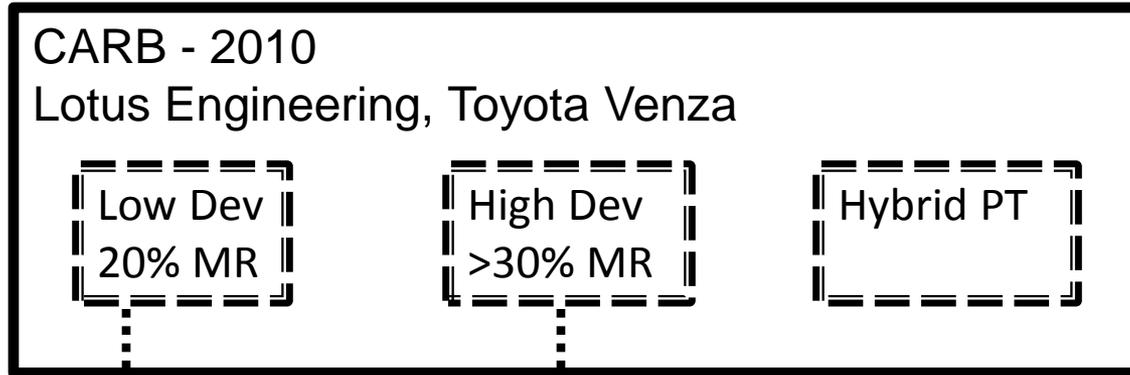
Aerodynamic drag reduction

Low drag brakes
Low rolling resistance tires
Secondary axle disconnect

Engineering Studies for Mass Reduction Feasibility and Cost



Agency Holistic Vehicle Studies



EPA – 2012
Toyota Venza
(FEV/EDAG)

CARB – 2012
Toyota Venza
(Lotus)

NHTSA – 2012
Honda Accord
(Electricore,
EDAG, GWU)

Future Work:

EPA – 2011-2014
Light Duty Truck
(FEV/EDAG)

NHTSA Potential
Light Duty Truck

CARB: Lotus Engineering
Toyota Venza (Phase 1)
Glider only

EPA/ICCT: FEV & EDAG
Venza low development
vehicle (Phase 2) –
Full vehicle

CARB/ICCT: Lotus
Engineering
Venza high development
vehicle (Phase 2) –
Body Structure and Closures

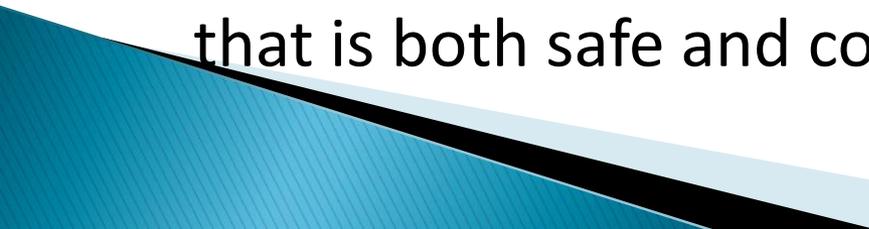
NHTSA: Electricore, EDAG
& GWU
Honda Accord –
Full vehicle

EPA Truck study in progress
NHTSA potential truck study

Assessment of Effects of Mass Reduction on Societal Safety



Assessment of Societal Safety

- ▶ NHTSA has long considered the potential safety effects in determining maximum feasible CAFE standards
 - ▶ If OEMs will reduce vehicle mass or build smaller vehicles in response to future CAFE standards, we want to anticipate:
 - Whether there will be safety implications
 - If so, what are those safety implications
 - ▶ CAFE standards should be designed to encourage manufacturers to pursue a path toward compliance that is both safe and cost-effective.
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Assessment of Societal Safety

NHTSA is assessing societal safety using two approaches:

- Backward Looking:
 - Statistical analysis of historical crash data
 - Study the effects of vehicle mass reduction and vehicle size on safety
- Forward Looking:
 - Engineering design and analysis approach
 - Crash simulation using CAE models
 - Use holistic light-weighted vehicle designs

Safety Assessment: Statistical Analysis of Historical Crash Data



NHTSA Statistical Analysis of Historical Crash Data

- ▶ Analyze historical crash data to assess the impact of vehicle mass and/or size changes on societal safety
- ▶ Why is statistical analysis of historical crash data useful to NHTSA's consideration of potential safety effects of CAFE standards?
 - It shows real-world trends in crash incidence and severity for smaller versus larger and lighter versus heavier vehicles – this information is not available elsewhere
 - It provides the agency with a substantial pool of data to analyze, which enables the agency to study various crash scenarios and exposures.
- ▶ However, there are some drawbacks to using historical crash data:
 - Data is historical – are we confident that it's representative of future trends?
 - Data are mixed from various crash scenarios/exposure. Sometimes there is not enough data to pinpoint the exact root cause.

NHTSA Statistical Analysis of Historical Crash Data

- ▶ Peer-Review of 20+ Studies
 - Independent review by UMTRI of the methodologies used in 20+ statistical studies
 - ▶ Creation of Common Database
 - Purpose: Reduce discrepancies among various studies due to use of different input data
 - Contains fatality data from MY 2000-2007 vehicle crashes in CY 2002-2008
 - ▶ Dr. Chuck Kahane's Updated Report
 - Uses the common database above
 - Responsive to comments from peer-reviews as well as from a NHTSA, DOE and EPA interagency team
 - Report published in August 2012
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Mass Reduction Applied in MYs 2017+ Final Rule

- In MYs 2017+ final rule, the agencies used vehicle weight reduction levels that maintained safety for the analysis.

The analysis shows a path that the industry could use to maintain overall fleet safety while meeting the new fuel economy standards.

- ▶ The following mass reduction levels were used in the analysis:
 - All vehicles must, of course, meet all applicable safety standards.
 - Relative to 2010 fleet levels

	Subcompact Car	Compact Car	Midsize Car	Large Car	MiniVan	Small Light Truck	Midsize Light Truck	Large Light Truck
Maximum Amount of Mass Reduction Allowed	0%	0%	3.5%	10%	20%	20%	20%	20%
Projected Industry Average Amount of Mass Reduction Applied in MY2025	0%	0%	3.5%	10%	15.3%	12.5%	10.2%	11.3%

Safety Assessment: Crash Simulation Modeling



NHTSA Safety Analysis Using Crash Simulation Modeling

- Sponsored by NHTSA
- Utilize finite element models of concept vehicles and on-road vehicles to evaluate safety of light-weighted vehicles
- Vehicle-to-vehicle and vehicle-to-object crashes
- Beyond crash conditions used for standards
 - Vehicle speed from 15mph – 40 mph;
 - Represents a broader array of crashes
 - Weighted by frequency of occurrence from the National Automotive Sampling System (NASS) database
- Interaction between light-weighted and non-light-weighted vehicles
- Evaluate potential countermeasures
 - Potentially different air-bag deployment timing for light-weighted vehicles
 - Adaptive occupant restraint systems

Next Steps

- ▶ Will be covered by other presenters later today and tomorrow.



THANK YOU!

